

Access to Potable water in Dschang Health District, West Cameroon: A Cross Sectional Descriptive study.

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Abstract

Background: Limited access to safe water is a prominent public health challenge. This leads to disease outbreak, thus resulting in high morbidity and mortality.

Objective: To evaluate access to potable water in Dschang Health District, West Cameroon.

Method: A descriptive cross-sectional household study was carried in Dschang Health District from 24 to 28 May 2010. A standard questionnaire was administered to household heads. Water samples collected were analysed using Colorimetric methods and Enzyme-linked Immunosorbent Assay (ELISA) and compared to WHO standards. Data collected were analyzed using the Epi-Info software version 3.5.3

Results: Of the 300 households visited, only 12% of participants were able to give the correct definition of potable water and 25% of households used water from spring and CAMWATER. Average daily quantity of water used per person was 9.88 liters. Physicochemical and bacteriological tests revealed the water sources were of poor quality in general as only 40% of the sources tested showed characteristics close to standard. Distance less than 30 m between water source and toilets was recorded for 33.2% of houses. The closest potable water source for 34.3% households was about a kilometer away and water was commonly treated by chlorination (22%). Financial constrains acted as a major barrier as 28% of households could not afford a CAMWATER connection nor a borehole in

their compounds. Lack of planning at CAMWATER resulted in 19.6% of houses unable to connect themselves to the water supply system.

Conclusion: Accessibility to potable water remains a major concern hence the need to revise current policies and strategies relative to safe drinking water.

Key words: Access to drinking water, water treatment, water borne disease, Dschang, Cameroon.

Introduction

World Health Organization (WHO) and the United Nations Children's Fund (UNICEF), estimate that roughly 780 million people around the world lack access to clean drinking water and 2.5 billion people (roughly 40% of the world's population) are without access to safe sanitation facilities [1,2]. Safe drinking water (according to WHO) is water that does not contain pathogens or chemical agents at levels of concentration that could be detrimental to health [3].

While consumption of contaminated water is responsible for 88% of the over four billion cases of diarrhoeal diseases that occur worldwide every year; and the 1.8 million deaths that result from them, it is also indirectly responsible for the 50% of childhood malnutrition associated to diarrhoeal diseases, and the 860, 000 deaths that result from them each year [4].

According to the United Nation's resolution A/RES/64/292 of August 3 2010, the right to safe and clean drinking water and sanitation is a human right that is essential for the full enjoyment of life and all human rights [5,6]. However, even though efforts are being made, Africa remains far from the achievement of the third component of primary health care agreed upon at Alma Ata-1978 which aimed at assuring "an adequate supply of safe water and basic sanitation for everyone" [1]; and past Millennium Development Goal (MDG) number 7 ("Halve, by 2015, the proportion of the population without sustainable access to safe drinking water and basic sanitation") [2,7,8]. Limited access to potable water and sanitation in Africa is not mainly a resource issue; though a third of countries experience some pressure on their internal water resources, they are overall considered abundant. The problem is one of poor management, pollution and wastage, as well as lack of facilities – except in Northern and South Africa. In most African cities over 50 per cent of the water supply is wasted or unaccounted for [9].

In spite of the full engagement of Cameroon in achieving the past MDGs since their inception, only 47% of rural settings and 59.8% of urban population had access to safe drinking water in the year 2010 [10]. However, rapid urbanization has rendered existing infrastructure inadequate with periurban dwellers also lacking access to safe drinking water. Sanitation coverage is also poor. In urban areas only 58% of the population has access to improved sanitation facilities, and the rate in

rural areas is 42%. Women and girls bear the largest burden in collecting water, 15% of urban and 18% rural populations using improved drinking water sources over 30 minutes away ^[11]. .

With reference to the past MDG, the objective regarding to safe water in Cameroon which targeted 72% of the population in 2015 and 75% in 2020 having access to potable water is still to be achieved ^[10]. National potable water coverage is assured by the Cameroon Water Utilities Corporation (CAMWATER) whose coverage remains limited regarding the rapidly growing population as only 23% of the urban population and 42% of rural residents are connected ^[12, 13]. .

Dschang is an agglomeration situated in the west region of Cameroon. It has a hilly topography covered by grass fields. This study suited its setting as Dschang harbors one of the state universities (The University of Dschang). The town has an urban and rural zone and its inhabitants have very diverse sources of water.

The aim of the current survey was to evaluate perception, knowledge and accessibility to potable water in Dschang health district to help frame evidence-based; pivotal in accelerating the process of meeting up with the novel Sustainable Development Goals (SDG).

Materials and Method

Study area and design.

Cameroon is hinged between West and Central Africa at the extreme northeastern end of the Gulf of Guinea. It lies between latitudes 28 and 138 north of the equator, extending from the Gulf of Guinea to Lake Chad over a distance of about 1,200 km and between longitude 88 and 168 east of the Greenwich Meridian and extends over a distance of 800 km at the widest portion. It has a total surface area of about 475,650 km², 466,050 km² surface area and a maritime surface area of 9,600 km². The country is ranked 49th out of 182 countries in the world in terms of abundant water supply. Compared to the per capita average annual internal renewable water resources of the world of 7,044 and 5,152 m³ for Africa ^[14].

We conducted a cross-sectional descriptive study during May 2010 in Dschang health district, western region, Cameroon. The Population of Dschang is amongst the highest of the region with close to 218006 inhabitants. Geographically, Dschang is located between 5°10' and 5°38' northern latitudes, and between 9°50' and 10°20' eastern longitudes, for a mean altitude of 1,400 m above sea level. The climate is characterized by one dry season that goes from mid-November to mid-March and a rainy season going from mid-March to mid-November. From a sanitary perspective, Dschang health district is made up of 22 health areas of which 4 urban and 1 rural.

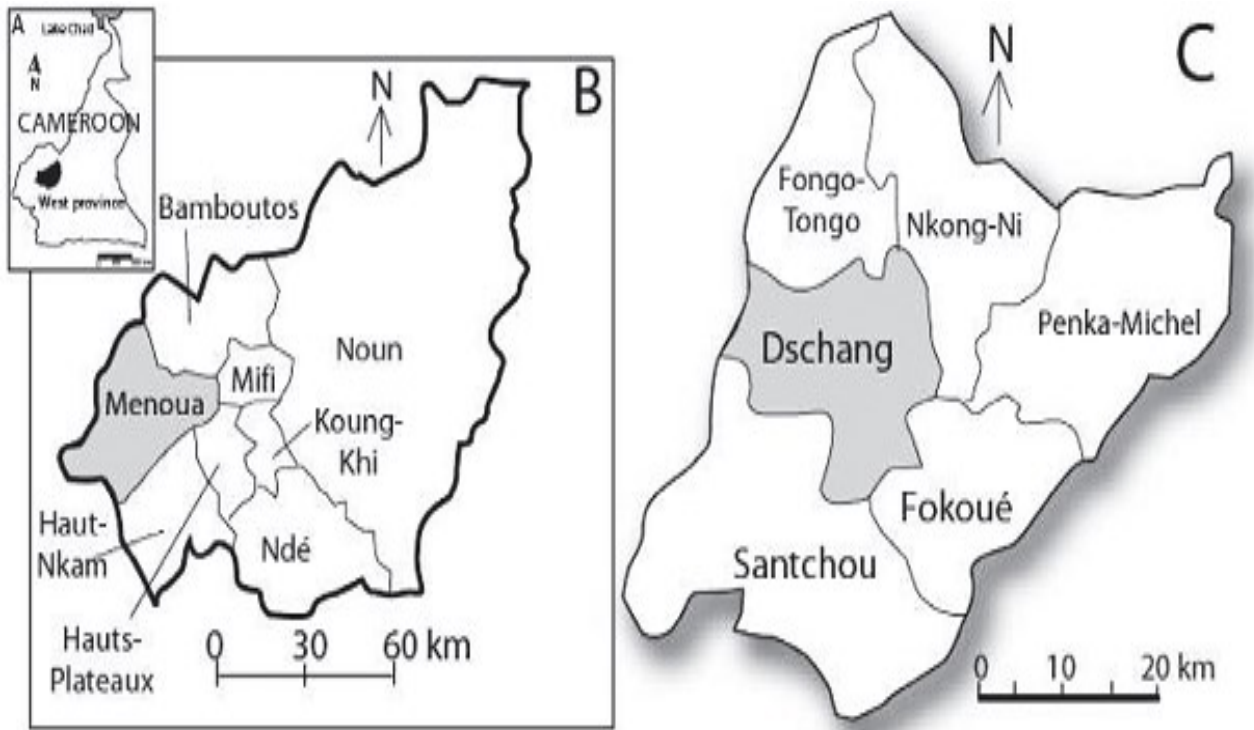


Fig 1: Geographical location of Dschang

Data collection

This survey was carried out as part of the training of Community immersion of level II students, Department of Biomedical Sciences, University of Dschang. 11 groups of about 9 to 11 investigators were formed, each with a supervisor or two. 7 of these groups carried on the study in 4 health areas (Fometa, Siteu, Fiala and Maka) selected randomly. In each health area, 5 quarters were also randomly selected. Here, investigators had to administer the standard pretested questionnaire to household heads and leaders of associations, carry out discreet observation on the source of water used, the hygienic conditions around this water source, the distance between the source of water and home... Before leaving a house, investigators sensitized the household members on water hygiene and sanitation, and introduce them to SODIS (Solar Disinfection) water treatment method. Samples of five mostly used water sources (water from CDE, spring water from Madagascar neighbourhood, well water from SINKOT student hostel, water from a stream that runs through the town - 'riviere de la regie' and the water capture up the summit of the university campus) were collected for analysis.

Data analysis

Overall, 20 urban and rural quarters, 300 homes, 42 water points were visited for the study from which data was collected. Individual questionnaires were crosschecked for data coherence and completeness. Water samples collected were analysed for their physicochemical and bacteriological qualities using volumetric titration, Colorimetric methods and Enzyme-linked Immunosorbent Assay (ELISA); and characterized according to WHO standards [3]. Data entry and analysis was performed using EPI –Info software, version 3.5.3. Tables and graphics were obtained with MS word and Excel.

Results

Population Perception of Potable Water

Findings from our survey indicate that each individual has his/her own definition of potable water. 80% of the participants defined potable water as colorless, 58.1% as odorless, 40.5% as tasteless, 33.3% as without microbes, 12% as water coming from a potable source, 4% as water without chemical substances and only 12% gave the correct definition of potable water. Most homes (57.8%) prefer spring water because it's free from germs they say and they use it both for drinking and other household activities. Generally, water from springs, boreholes and CAMWATER are used for drinking while others sources are used for other household activities. Majority of our study participants acknowledged that potable water is used for washing and cooking of food stuffs while not many remembered of it as being used too for washing of hands, plates, clothes, fruits, bathing etc. 84.8% of the respondents admitted their potable water is of doubtful quality, mostly as being dirty and sometimes of bad odor. Interestingly, for 86.8% of our participants, the consumption of unpotable water could cause diseases.

Access to Water:

Some water sources are preferred because of socio-cultural believes such as the notion of 'blessed water', especially water from some springs. Some phobia regarding CAMWATER due its financial inaccessibility, poor quality and quantity distribution was recorded. The choice of which water source to use was linked to financial means and socio-cultural believes. The geographical accessibility is limited due to poor roads.

As shown in figure 2, the major water source for the inhabitants of the Dschang Health District is the spring.

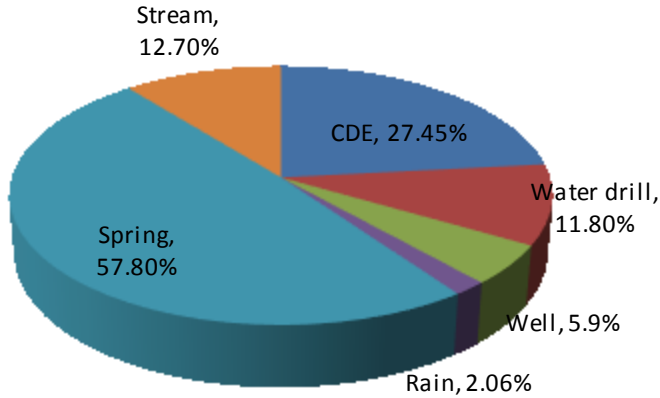


Figure 2: Water sources for households

Spring water known to be the most accessible water source was also recognized to be the most safe (48, 75%).

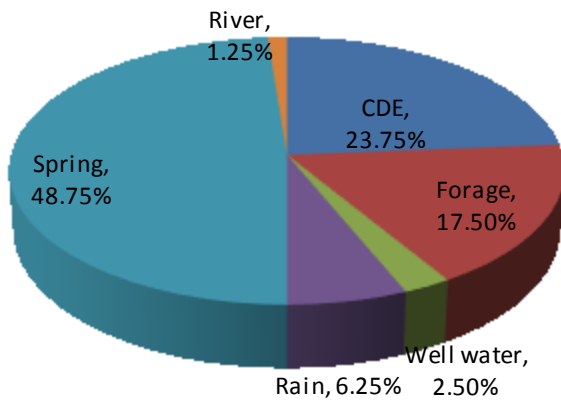


Fig 3: Most safe potable water sources according To house heads

A regulatory distance of 12 m between septic tanks and a water source is imperative according to WHO [15]. The proximity of water sources from neighboring toilets had corresponding variations

of < 30m for 33.2% of the water sources, > 30m for 18.5% and non-applicable for 48.4% of the water sources.

Table 1: Relative distance of water source from home (N=300).

Distance from water source to house	Frequency	Proportion (%)
<30 m	69	22.9
>30 m	124	41.4
~1000 m	103	34.3
> 10000m	4	1.4
Total	N	100%

Data from the survey revealed that each house contained an average of 6.94 persons and average 9.88 liters of water per person per day. WHO recommends a minimum quantity of 50 liters per capita per day to help cover basic needs [3]. In general, 54% of house heads questioned admitted experiencing ruptures in water supply in their homes while 46% had no complaints. Average water shortage specific to CAMWATER was found to be about 12 days per month.

Water treatment and conservation

The water quality could be altered from the source, on transit, during storage and usage. However, only 26% of houses visited conserved water in closed containers and the majority of houses conserved water for more than 3 days which could lead to its contamination or germ proliferation. Also, water is stored in containers of poor hygienic quality and there is absence of cleaning up activities around water sources

Regarding water treatment, only 21.2% of households visited treated water before drinking; mainly by **chloration**.

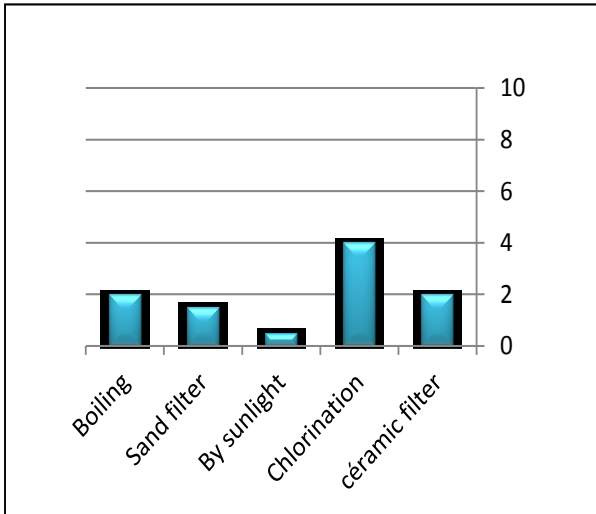


Fig 4: Water treatment before consumption

Concerning the incidence of water borne diseases, it was seen that close to 30% of children between 0-5 years suffered at least once episode of diarrhea in the past six months.

Table3: results of the physiochemical and bacteriological analyses of water samples obtained from the Dschang health district water sources

parameters under study	SNEC	Madagascar source	Campus	Well of the SINKOT student hostel		Reference values (According to WHO)	Régie stream
				Before SODIS	After SODIS		
physicochemical parameters							
Temperature in °C	22	21,5	22	21	22	< 25	21
Material in suspension -(MIS) in mg/l	251	0	245	249	251	0	249
Turbidity	0	0	0	0	0	0	5
Total Dissolved Solid matter – (TDS) en mg/l	22,2	41,6	21,8	93,3	58,2	50	28,8
Electric conductivity - (Cond.) in µS/l	47,4	88	46	195,6	121,7	100	61,1
Oxygen potential - (pH) in u.c	7,06	5,9	6,46	7,18	6,84	6,5 -8,5	7,29
Alcalinity in mg/l	18	20	20	42	50		30
Dissolved oxygen in mg d'O ₂ /l	3,1	2,5	2,7	2,8	2,8	7	0,9
Carbondioxide (CO ₂) in mg of CO ₂ /l				1,76	3,52		
Nitrates (NO ₃) in mg/l	0	0,7	0	0,5	1,5	50	0
Nitrites (NO ₂) en mg/l	0,002	0	0	0	0	10	0,005
Nitrogen ammonia (N-NH ₃) in mg/l	0	0	0	0	0	0,05	0,21
Orthophosphates PO ₄ ³⁻ in mg/l	0,17	0,14	0,08	0,13	0,42	02	0,45

parameters under study	SNEC	Source Madagascar	Campus	Well of the SINKOT student hostel		Reference values	Régie stream
				Before SODIS	After SODIS		
Physicochemical properties							
Fecal Coliformes (FC) in UFC/100ml)	31	0	3	0	0	0	
Fecal Streptococcus (FS) in UFC/100ml)	3	31	1	3	0	0	

Remarks

Cyto-bacteriological remarks

All these water samples present some risk for human consumption because of the presence of bio indicators of fecal origin such as fecal coliforms and fecal streptococcus. The most probable sources of this contamination are from humans for CAMWATER; animals for the Madagascar spring and well water; and from both animals and humans for the 'riviere de la regie'.

Physiochemical remarks

These water samples are of reasonable quality in terms of physico-chemical properties. It is important to note the acidic pH value (5.9) of the Madagascar spring which could be harmful for consumption. These water samples are weakly oxygenized, but without always exposing the population to serious health risks. The high content in suspension matter and dissolved solids could explain the weak oxygenisation of these water samples because of the oxygen demand associated with these suspended matters (which could be microbes). We should also note the satisfactory results after treatment with the SODIS method.

Discussion

In spite of the fact that data from this community investigation reveals that knowledge on the qualities of safe water remain poor as only a few proportion could give all the criteria of potable water, 86.8% of the sample population could nonetheless recognised that consuming potable water helps in the reduction of water borne diseases; this has brought to evidence by ^[16]. This represents a path forward as such knowledge may impact on the hygienic practices regarding water transportation, storage and consumption as well as the type of water used cooking, drinking and other closely related health activities at home.

Despite the numerous sources of water, access to potable water still remains a major problem in the Dschang health district. Financial inaccessibility of potable water is explained by an almost general poverty of the population that complains of high subscription fee, high bills, high cost of digging a well or borehole and difficulties in maintaining the existing water sources^[17]. Moreover as documented in some studies, coupled to the financial limits, the distance to the water source used by a household has been found to be a robust predictor of accessibility and probably of disease risk in that house-hold ^[18]. This is explained by the fact that the Dschang Health District is located in West Cameroon well known its hilly topography and inaccessible roads.

On average, the quantity of water available per person per day for the residents of the Dschang health district is less than half the quantity recommended by the WHO (50 litres) ^[3]. These findings have been documented in other studies ^[17].

Of particular concern is the finding that drinking water is stored in containers with poor hygienic conditions which concord with the fact that household practices related to the conservation of water in containers (e.g. buckets, drums and cans), or handling during transport can have a significant effect on its quality ^[19]. Consequently, even if the water is free from potentially harmful microbes at the source, it may be contaminated at home as a result of poor hygienic storage conditions ^[20]. Also, in Dschang health district, the proportion of people who treat water before consumption appears to be very low (21.2%), not up to one half the findings of a study carried out in some rural Riverine Communities in the Niger Delta Region, Nigeria ^[21]. Chlorination appears to be the major water treatment method in Dschang setting due to the fact that chlorination reagents are not only cheaper and readily available, but this method do not require time and exceptional expertise. This finding is contradictory to that of Elizabeth T et al ^[22], where water treatment by Chlorination was found to be amongst the least used methods.

Potable water is considered an essential component of individual and collective hygiene and close associations have been observed with sanitation ^[23, 24, 25]. As a result, the influence of water (and sanitation and hygiene) on health is undeniable ^[24, 26]. This is in line with our results as close to 30% of the children aged 0-5 years visited in this study suffered at least one episode of diarrhoea during the 6 months preceding the investigation. This is especially the case in environments where the rate of connection to public water supply is low and the available quantity of water is subject to practices that degrade the water quality by the introduction of pathogens ^[27].

The physico-chemical and bacteriological analyses of the water sources tested during this survey concord with those found in a study in Ethiopia which showed that the water quality is beyond the standards of the WHO ^[28]. As indicated in other studies, low PH value of the Madagascar source particularly may be due to saturation with carbon dioxide resulting from the activity of microorganisms as this water source contains the greater concentration of fecal coliforms ^[28]. In fact, the presence of significant counts of fecal coliform bacteria in general in the water sources is indicative of inadequacy of the depth of the wells or a breach of sanitary integrity of the wells ^[29]. The presence of coliforms in groundwater indicates that microorganisms from surface water have been able to reach the aquifer as supported by studies of Payment and Locas ^[30]. Indeed, the presence of fecal coliforms in tap water after disinfection indicates inadequate treatment ^[3].

Implication for intervention and policy

The present study shows that access to drinkable water in Dschang health district remains limited due to factors already cited. To face the issue; at the level of the government, measures should be taken to liberalized the water sector and encourage large scale pipe borne water companies. Existing water structures need to be renovated (old water pipes and reservoirs should be replaced).

The cost and time to subscribe for pipe borne water in a home needs to be significantly reduced and made affordable to the average citizen. The government should multiply the number of water points of potable source around every community and ensure durability and better conditions around them (good roads for example).

The community needs to part-take and if possible contribute in all water projects that concern their locality. They should be sensitized on personal and environmental hygiene and also educated on proper ways to transport, conserve and use water. The habit of treating water before usage need to be revived by an approach of communication for development (C4D) and the consequences of not doing this should be well emphasized upon by sensitization. In addition, each hospital or health center should have a bore hole or drill to guarantee good water quality and constant water supply so as to reduce cases of nosocomial infections.

Conclusion

Access to potable water is limited in Dschang health district. This phenomenon has direct and indirect consequences on the standard of living of the population in general (educational, health and socio-economic impacts) and arise as a result of; lack of good water access policies and infrastructures on one side and ignorance, illiteracy and poverty of the population on the other hand. Thus administrative policies need to be reviewed and community actions undertaken to lead long term accessibility and foster SDG targets linked to potable water.

Acknowledgements

We thank the Administration of the University of Dschang; Department of Biomedical Sciences, who facilitated the implementation of this study. Our thanks also go to the students of the Department of Biomedical Sciences who actively took part in the data collection and analysis phases of this study.

Conflicts of interest

The authors have no conflicts of interest to declare in relation to this study.

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